Identifying Behaviors and Mapping Decisions to Reduce Shoreline Armor

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Introduction

Project Background

The Puget Sound Marine & Nearshore Grant Program, co-led by Washington Departments of Fish and Wildlife and Natural Resources, funded this project with the goal of reducing the total amount of traditional "hard" armor along Puget Sound marine shorelines. This can be accomplished by a combination of reducing new armor and removing existing armor. Hard armor refers to structures placed on the upper beach and at the toe of bluffs typically to reduce erosion, and is referred to using a variety of terms in the Puget Sound region, including the terms bulkhead, seawall, revetment, and rockery. Armor has been associated with numerous negative impacts to the Puget Sound nearshore. The *Social Marketing Strategy to Reduce Puget Sound Shoreline Armoring* project describes how we can overcome barriers and motivate residential landowners to voluntarily choose alternatives to hard armor.

The project team has used social marketing principles to research and design a program that will help reduce the amount of hard armor along Puget Sound marine shorelines. It resulted in:

- A Sound-wide GIS database of residential marine shore properties, including audience segmentation based on shore characteristics, and prioritization based on high value shoreforms and habitats with documented ecological impacts from shore hardening
- Descriptions of priority segments in terms of size, demographics and additional parcel data
- Desired audience behaviors for each segment
- Prioritized list of barriers and motivations for each desired armoring behavior
- Social marketing strategies and interventions to encourage the desired behaviors
- Toolkit for stakeholders to use in implementing social marketing campaigns in Puget Sound
- Detailed evaluation plan and report that details all project findings

The goal for this project is to create a social marketing behavior change strategy designed to influence priority segments of residential shoreline landowners to make behavior changes related to shore armor in order to achieve grant program goals. The strategy will focus on realistic approaches that use research-based incentives to overcome the specific barriers to reducing shore armor among key target audience segments.

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Identifying Target Behaviors

Approach

The team first worked together to identify a set of nine initial target audience segments of residential marine shore property owners, organized by the following marine shore parcel characteristics:

- Armor Status (does the parcel currently have hard armor?)
- Structure Status (does the parcel currently have a home on the property?)
- Erosion Potential (based on shoretype and wave energy considerations, does the parcel have no, low, moderate, or high erosion potential?)
- Behavior objective (preserve unarmored condition OR remove armor where not necessary)

After the nine segments were identified, the consultant team worked with the Grant Program to identify behavior options for each audience segment. The options were prioritized according to their feasibility for the parcels and potential to address the Grant Program's ultimate goal of reducing the amount of hard armor along Puget Sound residential marine shorelines. The eleven behavior options were sorted into two groups: primary behaviors directly related to armoring and supporting behaviors that are good for shorelines, but don't necessarily lead to the goal of no net increase in hard armor along Puget Sound shorelines.

Primary behaviors

Primary behaviors contribute directly to preventing a net increase in, and ultimately decreasing, hard armor along shoreline properties

1. Leave shore unarmored
2. Remove all hard armor
3. Remove a portion of hard armor
4. Replace armor with soft shore protection

Supporting behaviors

Supporting behaviors, when implemented properly, can reduce the actual and perceived need for installation of shore armor through minimizing erosion and the initiation of landslides. These measures can head off erosion/landslide events that often trigger landowners to install armor.

1. Maintain native vegetation (trees, shrubs, groundcover, backshore)

- Maintaining native vegetation ensures that the shore is protected from erosion by strong root systems and preserves shoreline habitats for fish and wildlife. Maintaining original native vegetation is superior to clearing and planting, as original topsoil and root structure are more resilient to erosion and drought, and provide denser vegetation for habitat.

2. Plant native vegetation (trees, shrubs, groundcover, backshore)
    - Planting additional native vegetation enhances protection of the shore from erosion by improving strong root systems and preserves shoreline habitats for fish and wildlife.
3. Reduce surface water runoff reaching bluffs
    - Surface water runoff reaching bluffs can cause increased erosion and undermine other shoreline protection measures that are already in place.
4. Build with a generous setback (further from shoreline than current regulations require)
    - Building further from the shoreline than required can reduce risk to structures from erosion and also protects structures from future sea level rise. This is the most effective and long lasting secondary measure for avoiding the need for armor in the future.
5. Install soft shore protection on unarmored property
    - Soft shore protection on unarmored property is recommended only as a preferable alternative to hard armor when shoreline protection is deemed necessary, such as during the development of a sub-standard sized property.
6. Move home further from the shoreline
    - Moving homes further from the shoreline can mitigate risk to structures from erosion and also protect structures from sea level rise.
7. Obtain professional advice
    - Advice from professionals with knowledge of hard armor alternatives and realistic erosion risks will point shoreline property owners towards solutions (including no action, if appropriate) with the best long term results for their property and shoreline health.

Potential Behaviors Grid

	AUDIENCE SEGMENTS DETERMINED BY PARCEL CHARACTERISTICS								
ARMOR STATUS:	**NO ARMOR**				**ARMOR**				
HOME ON PROPERTY:	No Home		Home		No Home		Home		
EROSION POTENTIAL: *(EP criteria based on wave energy and shoretype, see Table 1)*	No Erosion Potential	Low-Mod Hi Erosion Potential	No Erosion Potential	Low-Mod-Hi Erosion Potential	No Erosion Potential	Low-Mod-Hi Erosion Potential	No Erosion Potential	Low-Mod Erosion Potential	High Erosion Potential
Segment number designation:	Segment 1	Segment 2	Segment 3	Segment 4	Segment 5	Segment 6	Segment 7	Segment 8	Segment 9
Percentage of shoreline length:	9%	14%	15%	24%	1%	6%	4%	26%	<1%
Number of residential parcels:	1,316	4,823	4,057	13,026	222	2,370	1,539	17,273	470
Percentage of residential parcels:	3%	11%	9%	29%	<1%	5%	3%	38%	1%
Percentage of shoreline armored:	0%	0%	0%	0%	42%	68%	63%	83%	81%
Number of responses to survey:	n=31	n=14	n=331	n=303	n=3	n=5	n=157	n-277	n=43
BEHAVIOR OBJECTIVE:	**PRESERVE UNARMORED CONDITION**				**REMOVE ARMOR WITHOUT RISKING HOME OR PROPERTY**				
BEHAVIORS TO CONSIDER *(Based on Parcel Type & Erosion Potential)*									
Maintain native vegetation (trees, shrubs, groundcover, backshore)[1]	X	X	X	X	X	X	X	X	X
Plant native vegetation	X	X	X	X	X	X	X	X	X
Address water drainage reaching bluffs[2]		X	X	X		X		X	X

[1]Backshore is defined as the upper zone of a beach beyond the reach of normal waves and tides, landward of the beach face. The backshore is subject to periodic flooding by storms and extreme tides, and is often the site of dunes and back-barrier wetlands.

[2] Drainage management should not route untreated stormwater from driveways, roads, or yards with any chemicals added to marine or fresh waters without adequate treatment; sites which do not require drainage management for reducing erosion should not install it for these and other reasons (such as broken pipes entering Puget Sound)

Leave shore unarmored	X	X	X	X					
Remove all armor					X	X	X	X	
Remove portion of armor						X		X	X
Replace armor with soft shore protection[3]						X	X	X	
Build further from shoreline than current regulations require	X	X			X	X			
Install soft shore protection on unarmored property	X	X	X	X					
Move home further from shoreline				X				X	X
Obtain expert advice regarding preserving unarmored condition or removing armor	X	X	X	X	X	X	X	X	X

Table 1. Erosion potential categories based on combined wave energy and shoretype. See Table 2 for shoretype abbreviations and descriptions.

Wave Energy	**FBE**	**FB**	**TZ**	**AS/BAB**	**NAD-LE**	**PB**	**NAD-B**
Low	Med EP	Med EP	Low EP	Low EP	No EP	Low EP	No EP
Med	High EP	Med EP	Med EP	Low EP	No EP	Low EP	No EP
High	High EP	High EP	Med EP	Med EP	No EP	Med EP	No EP

[3] Soft shore protection entails: applying beach nourishment and or large logs to beach/storm berm to buffer erosion, resloping/regrading bluffs that are actively eroding, and various combinations of the these techniques to reduce shore erosion with minimal impacts to nearshore ecosystem processes.

Table 2. Shoretype descriptions, abbreviations and data source that will be linked with parcel data and used for social marketing segmentation.

Shoretype	Abbreviation	Data Source	Description
Feeder bluff exceptional	FBE	MacLennan et al. 2013	High elevation bluff, contributing large volumes of sediment to the nearshore frequently from landslides and bluff toe erosion.
Feeder bluff	FB	MacLennan et al. 2013	Moderate elevation eroding bluff, occasional landslides and toe erosion.
Transport zone	TZ	MacLennan et al. 2013	Low-Moderate elevation bluff. Neutral – minor signs of erosion. Typically heavily vegetated.
Accretion shoreform/Barrier beach	AS/BAB	MacLennan et al. 2013/Simenstad et al. 2011	Depositional shores, typically low elevation backshore. Typically formed from long-term deposition processes may not currently be accreting, could be eroding.
Low energy shores	NAD-LE	MacLennan et al. 2013	Very sheltered shores, commonly protected by barrier (spit). These shores have No Appreciable Drift (NAD) of nearshore sediment due to lack of wave energy to entrain and transport sediment.
Pocket beach	PB	Simenstad et al. 2011	Beach contained between two (bedrock) headlands.
Bedrock shores	NAD-B	MacLennan et al. 2013	Bedrock shores. These shores have No Appreciable Drift (NAD) of nearshore sediment due to a lack of sediment due to bedrock geology.
Delta shores	NAD-D	MacLennan et al. 2013	Shores associated with large river systems and area dominated by fluvial processes.

Evaluating Opportunities to Influence Behavior and Environment Based on Research

Approach

Using insights gleaned from the quantitative research performed by ARN, the team scored each targeted primary and supporting behavior based on the perceived barriers to behavior change evaluated through the Survey of Shoreline Property Owners.

The team then analyzed the reported likelihood/willingness of landowners to engage in the Primary and Supporting behaviors as well as those who were already engaging in the behaviors (as determined through survey response or through the Sound-wide database) to determine the size of each behavior's market opportunity, i.e. the more open respondents are to a behavior, and the smaller the number of people that have already done the behavior, the greater the market opportunity.

Using that information, the team further scored the behaviors on their estimated environmental impact, as determined by the client/consultant team.

The team then assigned a rank score to measurements in each category, multiplied by a weight to generate an overall opportunity score.

Score weighting

A weight of 40 percent was applied to barriers, while a 30 percent weight was assigned to both market opportunity and environmental impact. The team emphasized barriers over other factors, since it is crucial to overcome barriers to behaviors when developing successful social marketing campaigns.

Interpretation

Through this process, the team identified the behaviors that have the opportunity to create the largest environmental impact based on scale of the perceived barriers to the behavior, the size of the market opportunity for the behavior, and the positive environmental impact the behavior produces.

The closer a behavior's score is to zero, the greater the amount of resources that should be dedicated to driving that behavior, as they (overall) have the greatest relative potential for environmental impact, homeowner willingness, and the greatest number of property owners that have not completed or are not currently engaged in the behavior as evidenced by either survey responses or parcel status data.

Primary behaviors

Behavior	Barriers to behavior change[1]	Rank score	Weight	Number of parcels for potential behavior	% very or somewhat likely to engage in the behavior	Market opportunity[2] (number of parcels multiplied by % likely to engage)	Rank score	Weight	Environmental impact[3]	Rank score	Weight	Opportunity score	Primary audience segment(s)
Leave shore unarmored	Low	1	40%	21,998	94%	20,678	1	30%	Very high	1	30%	0.33	1–4
Remove portion of armor	Medium	2	40%	21,874	14%	3,062	3	30%	High	2	30%	0.77	6, 8, 9
Replace armor with soft shore protection	High	3	40%	21,874	17%	3,719	3	30%	Very high	1	30%	0.80	6–8
Remove all hard armor	High	3	40%	21,874	8%	1,750	3	30%	Very high	1	30%	0.80	5–8

Supporting behaviors

Behavior	Barriers to behavior change[1]	Rank score	Weight	Number of parcels for potential behavior	% very or somewhat likely to engage in the behavior	Market opportunity[2]	Rank score	Weight	Environmental impact[3]	Rank score	Weight	Opportunity score	Primary audience segment(s)
Obtain expert advice	Low	1	40%	38,031	24%	9,127	2	30%	High	2	30%	0.53	All
Plant native vegetation	Low	1	40%	22,185	25%	5,546	2	30%	High	2	30%	0.53	All
Maintain native vegetation	Low	1	40%	4,980	90%	4,482	3	30%	High	2	30%	0.63	All
Address water drainage reaching bluffs	Low	1	40%	27,618	33%	9,114	2	30%	Medium	3	30%	0.63	2–4, 6, 8, 9
Build further from shore than current regs.	Medium	2	40%	8,731	7%	611	3	30%	Very high	1	30%	0.67	1, 2, 5, 6

require													
Install soft shore protection on unarmored property (where needed for erosion control)	Medium	2	40%	18,029	39%	7,031	2	30%	Medium	3	30%	0.77	1–4
Move home further from the shoreline	High	3	40%	36,545	1%	365	3	30%	Very high	1	30%	0.80	8, 9

1) Based on barriers and motivations analysis percentages from Table 26 in the Survey of Shoreline Property Owners
2) Willingness to engage percentages from Table 25 of the Survey of Shoreline Property Owners (100 less percentage in chart) multiplied by parcel data from Table 12 of the Puget Sound Shoreline Parcel Segmentation Report, i.e. number of parcels multiplied by percent likely to engage equals market opportunity
3) Based on scale of positive environmental impacts recommended by Coastal Geologic Services

Rank Key:
Barriers: High = 3, Medium = 2, Low = 1
Market opportunity: 0-5,000 parcels = 3, 5,001-20,000 = 2, 20,001-45,276 = 1
Environmental impact: Medium = 3, High = 2, Very high = 1

Mapping Decision Points

Approach

Based on information gathered through the team's literature review and interviews of marine shore landowners and influencers, the team developed a decision map identifying key choices landowners make as they consider shore protection measures. Along with identifying possible choices, the map highlights influencers who have the ability to impact a landowner's decision making at different phases in the process.

The shoreline armor decision map describes the following stages:

Landowner Stage: Stages of armor decision making for a marine shore landowner (or potential landowner) are identified at the top of the map. Depending on which stage the landowner is in, different influencers and social marketing tactics may be used to achieve positive outcomes for the shore.

Decision Tree: The decision tree flows from left to right, identifying the decisions marine shore landowners make in the process of managing their shoreline property. Each box in the tree is color coded (see Process Step Key) to denote influencers in that step. Ultimately, landowners will arrive at one of the outcomes in the rightmost column of the chart. Green outcome boxes represent positive outcomes for the shore, while red boxes represent negative outcomes.

Influencers: Influencers at each point in the tree are identified at the bottom of the chart. Key influencers identified by the team include realtors, neighbors, outreach staff, professional advisors, contractors, and permit office staff. The team also identified key roles for influencers in decisions regarding armor installation. Primary influencers and their desired roles include:

- **Realtors:**
  - Discuss maintenance costs and upkeep of hard armor
  - Promote values of maintaining or restoring the natural shore
  - Encourage consultation of professionals and provide contacts

- **Neighbors:**
  - Encourage value of natural shore
  - Discourage adding armor

- **Outreach Staff:**
  - Contact new home owners

  - Raise awareness that installation of armor results in progressive loss of beach area
  - Educate home owners about coastal processes and physical and ecological impacts of armor

- **Professionals:**
  - Assess true risk to buildings and determine if there is a need for shore protection
  - Determine feasibility for soft shore protection alternatives where buildings are at risk from coastal erosion and action is needed
  - Assess the condition and effectiveness of existing armor
  - Encourage actions that will leave shore in an unarmored state or the removal of existing armor if feasible

- **Permit Office Staff:**
  - Provide resources regarding regulatory and permit requirements
  - Provide resources regarding shore protection alternatives and impacts of hard armor
  - Review parcel characteristics and apply regulatory framework
  - Ensure consultation with qualified professionals to meet permit requirements
  - Deny unnecessary installation of hard armor

- **Contractors:**
  - Understand and abide by permit regulations and requirements
  - Understand characteristics of soft shore protection and differences from hard shore protection
  - Offer services to home owners in installing soft shore protection if needed

The team will use the map to inform social marketing strategies.

Shoreline Armor Decision Map

Landowner Stage: | Considering Purchase | Purchasing | No Action | Deciding to Take Action | Making Inquiry for Assistance | Selecting Action | Applying for Permit | Outcomes

Key decision point during property purchase

Key decision point (often due to erosion event)

Process Steps Key:

- Primary influencer: realtor
- Primary influencer: neighbors
- Primary influencer: outreach staff
- Primary influencer: professional
- Primary influencer: Permit office staff

Outcomes Key:

- Positive outcome
- Negative outcome

Considering Purchase of Shoreline Property

Influencer: Realtor

Purchase Property with no home or armor

(segments 1, 2)

Influencer: Realtor

Purchase property with home and no armor

(segments 3, 4)

Influencer: Realtor

Purchase property with no home, but with armor

(segments 5, 6)

Influencer: Realtor

Purchase property with home and armor

(segments 7, 8, 9)

Influencer: Realtor

Consider adding armor (usually occurs after an erosion event)

Influencers: Neighbors, Outreach staff, Realtor (if selling property)

Evaluate condition and impacts of armor (usually occurs after an erosion event)

Influencers: Neighbors, Outreach staff, Realtor (if selling property)

Decide shore protection is needed

Decide there is no need for shore protection

Decide armor is failing or needs work

Decide to change armor due to aesthetics, concern about negative impacts or other factors

Consult Professional

Influencer: Professional/ Contractor

Consult/Hire Professional

Influencer: Professional/ Contractor

Choose to install shore protection

Influencer: Professional/ Contractor

Choose to forgo shore protection and leave natural shore

Influencer: Professional/ Contractor

Decide to completely or partially remove armor

Influencer: Professional/ Contractor

Decide to replace armor with soft shore protection

Influencer: Professional/ Contractor

Decide to replace hard armor or add to existing

Influencer: Professional/ Contractor

Apply for permit

Influencer: Professional/ Contractor, Permit office staff

Apply for permit

Influencer: Professional/ Contractor, Permit office staff

Native vegetation installed

Soft shore protection installed

Hard armor installed

No action taken - natural shore preserved

Decide current armor should remain in place and/or be repaired or replaced

Armor removed

Soft shore protection installed

Hard armor installed

Influencer(s):

Realtor

Realtor (if selling)

Neighbor

Professional/Contractor

Permit Staff

Outreach Staff